Life Expectancy in the United States

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Summary

As a result of falling age-specific mortality, life expectancy rose dramatically in the United States over the past century. Final data for 2003 (the most recent available) show that life expectancy at birth for the total population has reached an all-time American high level, 77.5 years, up from 49.2 years at the turn of the 20th century. Record-high life expectancies were found for white females (80.5 years) and black females (76.1 years), as well as for white males (75.3 years) and black males (69.0 years). Life expectancy gaps between males and females and between whites and blacks persisted.

In combination with decreasing fertility, the life expectancy gains have led to a rapid aging of the American population, as reflected by an increasing proportion of persons aged 65 and older. This report documents the improvements in longevity that have occurred, analyzing both the underlying factors that contributed to mortality reductions and the continuing longevity differentials by sex and race. In addition, it considers whether life expectancy will continue to increase in future years. Detailed statistics on life expectancy are provided. A brief comparison with other countries is also provided.

While this report focuses on a description of the demographic context of life expectancy change in the United States, these trends have implications for a wide range of social and economic programs and issues that are likely to be considered by Congress.

This report will be updated upon release of final data for 2004 by the National Center for Health Statistics (NCHS).

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Introduction

This report considers population longevity in the United States, as measured by life expectancy.[1] Life expectancy is the expected number of years to be lived, on average, by a particular cohort,[2] if current mortality trends continue for the rest of that cohort's life.[3] It most commonly refers to life expectancy *at birth*, the median number of years that a population born in a particular year could expect to live. For instance, based on recently released final data, life expectancy at birth in 2003 was 77.5 years.[4] This tells us that, for those born in calendar year 2003 in the United States, 50% will die before that age; the other half will live longer.

Life expectancy is also routinely calculated for other ages. Life expectancy at age 60, for instance, refers to the *additional* number of years that a person who has already attained age 60 will live beyond age 60. Life expectancy at age 60 in the year 2003 was 22.2 years in the United States.[5] A person who reached age 60 in 2003 was expected to live an additional 22.2 years, on average, and would die at age 82.2. While this report concentrates on trends and differentials in life expectancy *at birth*, **Appendix B Table B-2** provides estimates of life expectancy at selected additional ages in 2003 (the most recent final data available).

Measures of life expectancy are published in official life tables, which are based on age-specific death rates. In the United States, data on mortality are collected and compiled through the vital statistics system by the Centers for Disease Control and Prevention (CDC)/National Center for Health Statistics (NCHS). The most recently released *final* data on deaths and mortality are for calendar year 2003;[6] preliminary estimates are often released by NCHS but are generally not referred to in this report.

The concept of life *expectancy*, which considers the average experience for a population, is distinct from the concept of life *span*, which considers the upper limit of human life that could be reached by an individual. According to the U.S. Census Bureau, International Data Base,[7] the highest attained life expectancy to date for a national population was that of Andorra in 2006, when life expectancy was 83.5 years for the total population (86.6 years for females; 80.6 years for males). The oldest authenticated female life span thus far recorded was for J. Calment of France, who died at age 122 years, 164 days, and, for a man, C. Mortensen (a Danish immigrant to the U.S.), who died at age 115 years, 252 days.[8] There is a lively debate among researchers regarding whether the biological limits of life spans have been reached or whether future increases are probable. Life spans are not considered further in this report.

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[1] Research assistance provided by Angela Napili, Librarian, Knowledge Services Group of the Congressional Research Service.

[2] Persons born in particular year, see **Appendix A**, Glossary.

[3] Life expectancy is a hypothetical measure that applies today's age-specific death rates to predict the future survival of a cohort. It would technically be more accurate to follow the cohort through time and apply the *actual* age-specific death rates that the cohort experiences as it moves through its life course, but calculation of actual life expectancy would then require more then 100 years (until the death of the last survivor in the cohort).

[4] National Center for Health Statistics (NCHS), "Deaths: Final Data for 2003," *National Vital Statistics Report (NVSR)*, vol. 54, no. 13, Apr. 19, 2006. (Hereafter cited as: NCHS, Deaths: Final Data for 2003).

[5] National Center for Health Statistics, "United States Life Tables, 2003," *National Vital Statistics Report (NVSR)*, vol. 54, no. 14, Apr. 19, 2006.

[6] NCHS, Deaths: Final Data for 2003.

[7] At http://www.census.gov/ipc/www/idbnew.html, accessed Aug. 11, 2006.

[8] Max Planck Institute for Demographic Research, International Database on Longevity, at http://www.supercentenarians.org/, accessed Aug. 11, 2006.

This report documents the improvements in life expectancy that have occurred, analyzing both the underlying factors that contributed to mortality reductions as well as the continuing longevity differentials by sex and race. In addition, it considers whether life expectancy will continue to increase in future years. While this report focuses on describing the demographic context of longevity change in the United States, these trends have implications for a wide range of social and economic issues that are likely to be considered by Congress. For instance, one consequence of lengthening life expectancies is that the older population's needs for care—assistance with daily tasks to allow continued community-living for high-functioning seniors, institutions for those with more severe disabilities or cognitive impairments, training of a specialized work force in geriatric care—are likely to increase, particularly for the oldest-old. There are also questions with respect to ensuring basic income support, medical care, and housing for the older population. At the same time, there is the recognition that government programs, such as Social Security and Medicare, will face financial pressures to meet the increasing needs. What program changes are required to ensure the continued viability of such programs as the number of beneficiaries increases? What will be the federal government's role in an environment of competing demands for limited resources?

Trends in the Level of Longevity Over the Past Century

As seen in **Table 1** and **Appendix B Table B-1**, life expectancy at birth increased dramatically over the past century in the United States—from 49.2 years (the average for 1900-1902) to 77.5 years in 2003, the most recent year for which official data have been released by the Centers for Disease Control (CDC)/National Center for Health Statistics (NCHS).

Table 1. U.S. Life Expectancy at Birth, by Sex, in Selected Years

(in years)

Years	Total	Males	Females
1900-1902	49.2	47.9	50.7
1909-1911	51.5	49.9	53.2
1919-1921	56.4	55.5	57.4
1929-1931	59.2	57.7	60.9
1939-1941	63.6	61.6	65.9
1949-1951	68.1	65.5	71.0
1959-1961	69.9	66.8	73.2
1969-1971	70.8	67.0	74.6
1979-1981	73.9	70.1	77.6
1989-1991	75.4	71.8	78.8
2002	77.3	74.5	79.9
2003	77.5	74.8	80.1

Source: For data through 2002, the Congressional Research Service (CRS) compilation from National Center for Health Statistics (NCHS), United States Life Tables, 2002, *National Vital Statistics Reports*, vol. 53, no. 6, Nov. 10, 2004. For 2003, NCHS, Deaths: Final Data for 2003, *National Vital Statistics Reports*, vol. 54, no. 13, Apr. 19, 2006.

Notes: Later year estimates are more reliable than those of the early 20th century. The federal civil registration system began in 1900 with the setting up of the Death Registration Area (DRA). States were only admitted as qualification standards were met. Only 10 states and the District of Columbia were in the original DRA of 1900. Statistics prior to 1939-1941 are based on data from the DRA states (which increased in number over time).

Alaska and Hawaii are first included in 1959-1961 figures. Also note that data for years 1999-2001 are not reported in this data source.

Gains in longevity were fastest in the first half of the 20th century. These advances were largely attributed to "an enormous scientific breakthrough—the germ theory of disease" which led to the eradication and control of numerous infectious and parasitic diseases, especially among **infants and children**.[9] The new theory led to an entirely new approach to preventative medicine, practiced both by departments of public health and by individuals. Interventions included boiling bottles and milk, washing hands, protecting food from flies, isolating sick children, ventilating rooms, and improving water supply and sewage disposal.[10] Beginning in the 1940s, the control of infectious diseases was also aided by the increasing distribution and usage of antibiotics, including penicillin and sulfa drugs.

Since mid-century, advances in life expectancy have largely been attributable to improvements in the prevention and control of the chronic diseases of **adulthood**. In particular, death rates from two of the three major causes of death in 1950—diseases of the heart (i.e., coronary heart disease, hypertensive heart disease, and rheumatic heart disease) and cerebrovascular diseases (stroke)—have fallen by approximately 60% and 70%, respectively, on an age-adjusted basis[11] since 1950 (see **Table 2**), improvements that the CDC has characterized as "one of the most important public health achievements of the 20th century."[12]

Table 2. Age-adjusted Death Rates for Various Causes of Death

(per 100,000 population)

Cause	1950	1980	2002
All causes	*1,446.0*	*1,039.1*	*832.7*
Diseases of heart	586.8	412.1	232.3
Malignant neoplasms	193.9	207.9	190.0
Cerebrovascular diseases	180.7	96.2	53.5
Chronic lower respiratory diseases	—	28.3	43.3
Influenza and pneumonia	48.1	31.4	22.0
Chronic liver disease and cirrhosis	11.3	15.1	9.3
Diabetes mellitus	23.1	18.1	25.3
Unintentional injuries (incl. motor accidents)	78.0	46.4	37.3

[9] S.H. Preston and M. Haines, *Fatal Years: Child Mortality in Late Nineteenth Century America*, National Bureau of Economic Research, Series on Long-Term Factors in Economic Development (Princeton, NJ: Princeton University Press, 1991).

[10] Preston and Haines rule out formal health care (doctors, hospitals, drugs, and therapies) as the primary catalyst for longevity improvements during this period, as most of the decline had occurred before any effective therapies were available. Also, the mortality experience of physicians and their families was not significantly different from that of the general population. Evidence from other industrialized countries also supports this conclusion about early-century mortality declines. See (1) T. McKeown , et al., 1975, "An Interpretation of the Decline of Mortality in England and Wales During the 20th Century," *Popl Studies*, vol. 29:391:422; (2) S.H. Preston, and E. Van de Walle, "Urban French Mortality Decline," *Popl Studies*, vol. 32(2), pp. 275-97, 1978.

[11] CRS calculations from NCHS, *Health, United States*, 2005, *With Chartbook on Trends in the Health of Americans*, 2005, Table 29. Uses 2000 standard population.

[12] CDC, "Achievements in Public Health, 1900-1999, Decline in Deaths from Heart Disease and Stroke, U.S., 1900-1999," *MMWR Weekly*, Aug. 6, 1999, vol. 48(30), pp. 649-656.

Source: CRS compilation from National Center for Health Statistics (NCHS), *Health, United States, 2005 with Chartbook on Trends in the Health of Americans,* Table 29.

The CDC[13] attributes the declines in diseases of the heart and cerebrovascular diseases to a combination of

- *medical advances*, including

  —discoveries in diagnosing and treating heart disease and stroke;

  —development of effective medications for treatment of hypertension and hypercholesterolemia;

  —greater numbers of specialists and health-care providers focusing on cardiovascular diseases;

  —an increase in emergency medical services for heart attack and stroke; and

  —an increase in coronary-care units.

- *changes in individually controlled behaviors*, including

  —declines in cigarette smoking;

  —decreases in mean blood pressure levels;

  —an increase in persons with hypertension who have the condition treated and controlled;

  —a decrease in mean blood cholesterol levels; and

  —changes in the American diet (reductions in the consumption of saturated fat and cholesterol).

Beyond medical interventions, public health measures, and individual behaviors, a number of additional factors are known to be associated with mortality decline. They are briefly mentioned here, but it is beyond the scope of this report to discuss them in detail or to disentangle them from the factors already described:

- *Socioeconomic status (SES)*. Higher SES persons tend to be better educated, have higher incomes, and practice better individual behaviors (less smoking, healthier diets, etc.), and are more likely to have financial resources or health insurance to ensure access to medical care.
- *Social policies*. Some social policies, such as Medicare and Medicaid, are oriented to health improvements. Both programs were designed to increase access to health care for vulnerable populations, the elderly and the poor, with the ultimate goal of improving health for these groups. Other social policies, such as Social Security, affect income, and may affect health and well-being through that channel. Finally, some social policies may affect health by changing the access that people have to already-established resources. An example is the combination of civil rights legislation and improved health programs for the poor during the mid-1960s, especially through Medicaid.[14]

[13] Ibid.

[14] D.M. Cutler and E. Meara, *Changes in the Age Distribution of Mortality Over the 20th Century*, NBER, Working Paper No. W8556, October 2001.

A Quick Global Comparison

Life expectancy in the United States, for both men and women, is significantly higher than the *global* average but is only slightly higher than the average for *more developed countries*[15] (see **Table 3**). Life expectancy surpasses that of the United States in a large number of countries, including but not limited to Japan, Andorra, Canada, Hong Kong, Macau S.A.R, Singapore, Sweden, Australia, Martinique, Greece, Israel, Aruba, Italy, Netherlands, Norway, France, Liechtenstein, Monaco, Spain, and more. Estimates are provided for a non-comprehensive list of selected counties in **Table 3**. The United States was ranked 48th among 227 countries and territories for both sexes.

Table 3. Life Expectancy at Birth (in Years) in Selected Countries: A Global Comparison in 2006

	Both Sexes	Males	Females
World	*64.8*	*63.2*	*66.5*
Less Developed Countries	63.4	62.0	64.9
More Developed Countries	76.8	73.2	80.5
Andorra	83.5	80.6	86.6
Macau S.A.R.	82.2	79.4	85.2
Singapore	81.7	79.1	84.5
Japan	81.2	78.0	84.7
Switzerland	80.5	77.7	83.5
Australia	80.5	77.6	83.5
Canada	80.2	76.9	83.7
Greece	79.2	76.7	81.9
United States	**77.8**	**75.0**	**80.8**
Cyprus	77.8	75.4	80.3
Denmark	77.8	75.5	80.2

Source: CRS compilation based on data from the U.S. Census Bureau's International Data Base, available at http://www.census.gov/ipc/www/idbnew.html, accessed Aug. 10, 2006.

What Will Be the Future Course of American Longevity?

The Social Security Trustees report to Congress on the actuarial status of the Trust Funds annually. The long-range projections needed for this assessment depend critically on assumptions for the future course of longevity. According to Steven Goss, chief actuary of the Social Security Administration (SSA), their future mortality assumptions are based on the recorded average

[15] This characterization by the Census Bureau divides 227 countries and territories into two groupings: "More developed" includes Japan, Australia, New Zealand, countries of North America (excluding Latin America and the Caribbean), Europe, the Baltics, and the four European countries of the NIS (Russia, Ukraine, Belarus, and Moldova). Other countries are considered to be "less developed." U.S. Census Bureau, International Population Reports WP/02, *Global Population Profile: 2002* (Washington, DC: GPO, 2004). See, also, the Central Intelligence Agency (CIA), The World Factbook, at https://www.cia.gov/cia/publications/factbook/ rankorder/2102rank. html.

annual mortality decline for the total U.S. population aged 65 and older between 1900 and 2000.[16] He asserted that assuming future mortality improvement at nearly the same rate as for the last century—a little more than 0.7% annually—is a reasonable assumption, with a roughly equal likelihood of doing better or worse. This rate of improvement is more optimistic—about twice as large—as experienced during the last 18 years of the 20th century. Goss further suggested that "matching the accomplishments of the past century will not be easy. AIDS, SARS,[17] and antibiotic resistant microbes, along with increasing obesity[18] and declining levels of exercise, remind us that mortality improvements will not be automatic. Gains from replacement organs and genetic engineering will be expensive, and may be difficult to provide for the population as a whole."[19] SSA's projections of period life expectancy are shown in **Table 4**.

A benefit of the statistical methods that have emerged to extrapolate historical mortality trends to the future is that they have worked well and are relatively simple and efficient.[20] In addition to being utilized by SSA, similar approaches are also used in Canada and in the United Kingdom (UK). Canada's approach assumes that economic productivity is the overall driving factor for sustained longevity improvements, and projects a relationship between future mortality decline and future real growth in employment earnings.[21] The UK extrapolates trends from 15 years of past data to help define base starting points and establish initial rates of mortality improvement for projections. An assumption is also made that there will be a gradual slowing of rates of improvement after the first 10 years.[22]

Table 4. Projected Life Expectancies, SSA, in Selected Years

(in years)

	At Birth		At Age 65	
Year	Male	Female	Male	Female
2005	74.8	79.6	16.2	19.0
2025	77.0	81.2	17.5	20.0

[16] Testimony of SSA S.C. Goss, chief actuary, in U.S. Congress, Senate, Special Committee on Aging, *The Future of Human Longevity: How Important Are Markets and Innovation?*, hearings, 108th Congress, first session, June 3, 2003, S.Hrg. 108-192 (Washington: GPO, 2003).

[17] SARS (Severe Acute Respiratory Syndrome), a viral respiratory illness caused by a coronavirus. SARS was first reported in Asia in Feb. 2003. Over the next few months, the illness spread to more than two dozen countries in North America, South America, Europe, and Asia before the SARS global outbreak of 2003 was contained. See http://www.cdc.gov/ncidod/sars/factsheet.htm, accessed Feb. 7, 2005.

[18] See, for instance, S.J. Olshanky and colleagues, "A Potential Decline in Life Expectancy in the United States in the 21st Century," New England Journal of Medicine, 352:11, pp. 1138-1145. The researchers argue that, over the next few decades, life expectancy for the average American could decline by as much as five years unless aggressive efforts are made to slow rising rates of obesity.

[19] Testimony of SSA S.C. Goss, chief actuary, in U.S. Congress, Senate, Special Committee on Aging, *The Future of Human Longevity: How Important Are Markets and Innovation?*, hearings, 108th Congress, first session, June 3, 2003, S.Hrg. 108-192 (Washington: GPO, 2003).

[20] R.B. Friedland, "Life Expectancy in the Future: A Summary of a Discussion Among Experts," *North American Actuarial Journal*, vol. 2, no. 4, Oct. 1998. (Hereafter cited as Friedland, Life Expectancy in the Future, 1998). See also, (1) S.C. Goss and colleagues, "Historical and Projected Mortality for Mexico, Canada, and the United States," and (2) M. Sze and colleagues, "Effect of Aging Population with Declining Mortality on Social Security of NAFTA Countries," both in *North American Actuarial Journal*, vol. 2, no. 4, October 1998.

[21] B. Dussalt, cited in Friedland, Life Expectancy in the Future, 1998.

[22] C. Daykin, cited in R.B. Friedland, Life Expectancy in the Future, 1998.

Year	At Birth		At Age 65	
	Male	Female	Male	Female
2050	79.4	83.2	18.9	21.4
2075	81.3	84.9	20.2	22.7

Source: CRS compilation from the 2005 Annual Report of the Board of Trustees of Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds, Table V, A3.

Notes: Interpretation of life expectancy at age 65, the average number of *additional* years that a person will live, assuming that he or she has already attained age 65. For example, a 65-year-old woman in the year 2005 will live, on average, an additional 19.0 years—to age 84.0 years (65.0 + 19.0). Table refers to SSA's intermediate-range period life expectancies.

Future mortality and survival are, however, difficult to predict and specialists disagree on not only the level but also the direction of future trends. James Vaupel, director of the Max Planck Institute for Demographic Research, argues that the Social Security projections are too pessimistic.[23] He notes that SSA's forecast is that female life expectancy in the United States will gradually rise from 79.5 years today to 83.4 years in 2050.[24] SSA's projected level of life expectancy in 2050, half-a-century from today, is less than *current* life expectancy in Japan and France, and is 13 to 14 years less than likely Japanese and French female life expectancy in 2050. Vaupel further suggests that it is unrealistic for SSA to assume that the United States will be unable to match the level of life expectancy in half-a-century that is already attained in other countries today.

A number of articles suggested that current models may be too pessimistic in their assumptions about mortality and survival probabilities (i.e., Americans may live longer than currently projected).[25] Two of these studies showed that there has been a tendency for international life expectancy to rise linearly by more than two years per decade over the past 40 years[26] or the last 160 years,[27] a more rapid pace than suggested by current models. Also, useful analyses of the contributions of smoking behavior to mortality trends[28] in the United States suggests that slow female gains in life expectancy over the past few decades may be temporary, and that the pace may pick up fairly soon.

[23] Testimony of J. W. Vaupel, director, Max Planck Institute for Demographic Research, in U.S. Congress, Senate, Special Committee on Aging, *The Future of Human Longevity: How Important Are Markets and Innovation?*, hearings, 108th Congress, first session, June 3, 2003, S.Hrg. 108-192 (Washington: GPO, 2003).

[24] Note that cited figures differ slightly from those in **Table 4**. Vaupel was referring to the *2003* Social Security Trustees Report, **Table 4** presents the most recent data from the *2005* Trustees Report. This section is also presented in CRS Report RL32701, *The Changing Demographic Profile of the United States*, by Laura B. Shrestha.

[25] R. Lee, *Report for the Roundtable Discussion of the Mortality Assumption for the Social Security Trustees*, note dated Sept. 11, 2002, http://www.ceda.berkeley.edu/papers/rlee/ TrusteesPresentation02.pdf, accessed Aug. 11, 2006. (Hereafter cited as Lee, 2002).

[26] K. White, "Longevity Advances in High Income Countries, 1955-96," *Population and Development Review*, vol. 28, no. 1, March 2002, pp. 59-76.

[27] J. Oeppen, and J. Vaupel, "Broken Limits to Life Expectancy," *Science*, vol. 296, May 10, 2002, pp. 1029-1030.

[28] Also, see the section in this report on "Sex Differentials". Sources: (1) S.H. Preston and H. Wang, 2005, "Sex Mortality Differentials in the United States: The Role of Cohort Smoking Patterns," University of Pennsylvania, Working Paper 2005-01, at http://rider.wharton.upenn.edu/~prc/PRC/WP/Preston-Wang%20BWP%201%20-9-1-05.pdf, accessed Aug. 11, 2006. (Hereafter cited as Preston and Wang, 2005); (2) F. Pampel, "Cigarette Use and the Narrowing Sex Differential in Mortality," *Population and Development Review*, vol. 28, no. 1, March 2002, pp. 77-104. (Hereafter cited as Pampel, 2002); (3) R. Lee, 2002; and (4) J. Bongaarts, "A Decomposition of Life Expectancy Levels and Trends", paper presented at the annual meeting of the Population Association of American, Los Angeles, CA, 2006.

Technological advances also have the potential to expand life. The National Institute on Aging supports extensive analyses of genetic contributions to longevity in diverse species, as well as on the diseases and conditions that are responsible for premature death.[29]

Differentials in Life Expectancy

Sex Differentials

Life expectancy worldwide is generally higher for females than for their male counterparts.[30] The United States is no exception; female life expectancy exceeded that of males in all years of the past century (see **Figure 1**).

The average girl born at the turn of the 20th century in the United States could expect to live 50.7 years, roughly three years more than an American boy born at the same time. From 1900 to 1975, the difference in life expectancy increased from 2.0 years to 7.8 years, with females continuing to have the longevity advantage.[31] In the absence of war, such large differences between the sexes in life expectancy—which were also being recorded in other developed countries—are a relatively recent phenomenon in demographic history.[32] For the United States, NCHS attributed the increasing gap during these years to increases in male mortality due to ischemic heart disease and lung cancer, which were largely the result of men's early and widespread adoption of cigarette smoking. In the mid- to late 1970s, the average gap in life expectancy approximated the average gap seen in developed countries today—roughly seven years.[33] The gap has been recorded as great as 13 years, as seen in parts of the former Soviet Union in recent years as a result of unusually high levels of current adult male mortality.[34]

[29] Examples of technological advances and promising areas of research are provided in the testimony of R. Hodes, Director, National Institute on Aging, to a Hearing of the Senate Special Committee on Aging on *The Future of Human Longevity: How Important Are Markets and Innovation?*, June 3, 2003.

[30] A handful of exceptions includes a few countries in Africa (with high, and differential, rates of mortality due to HIV/AIDS) or in South Asia (where women's mortality rates had traditionally been higher due to lower social status and difficult life conditions).

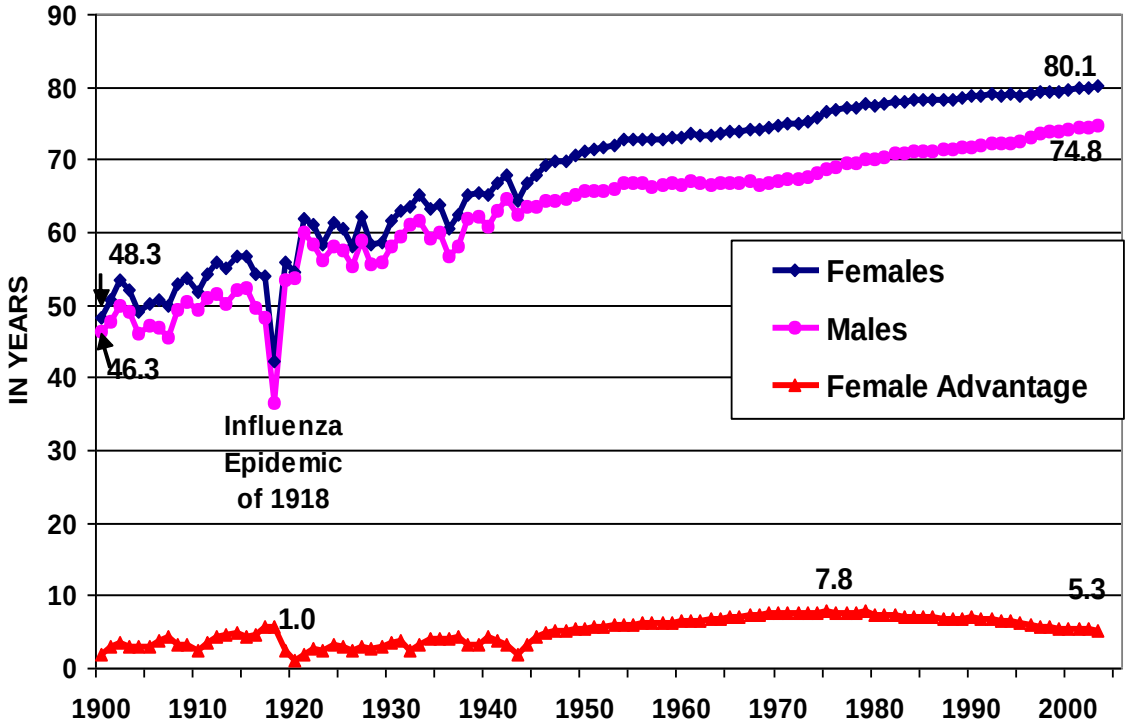
[31] Exact years not shown in **Figure 1**.

[32] United Nations, *Sex Differentials in Life Expectancy and Mortality in Developed Countries: An Analysis by Age Groups and Causes of Death from Recent and Historical Data*, Popul Bull of the United Nations, No. 25-1988, ST/ESA/SER.N/25.

[33] K. Kinsella and Y.J. Gist, *Gender and Aging, International Brief: Mortality and Health*, Census Bureau, IB/98-02, October 1998.

[34] Ibid.

Figure 1. Life Expectancy at Birth, by Sex: 1900 to 2003.



Source: For 1900-2002, CRS analysis based on data contained in NCHS, United States Life Tables, 2002, *National Vital Statistics Report,* vol. 53, no. 6, Nov. 10, 2004. For 2003, CRS analysis based on NCHS, Deaths: Final Data for 2003, *National Vital Statistics Report*, vol. 54, no. 13, Apr. 19, 2006.

Notes: Later year estimates are more reliable than those of the early 20th century.

Since 1979, the "female advantage" in life expectancy between the sexes in the United States has narrowed from 7.8 to 5.3 years, reflecting proportionately greater increases in lung cancer mortality for women than for men and proportionately larger decreases in heart disease mortality among men.[35] The average girl born in 2003 in the United States could expect to live 80.1 years compared to 74.8 years for a boy born in the same year.

A now dated, but still informative, study evaluated the contributions of various causes of death to the size of sex differentials in life expectancy in developed countries for the early 1980s.[36] Diseases of the circulatory system were found to account for nearly 40% of the mean sex differential in life expectancy; neoplasms (cancer) for 18%, accidents, suicide, and violence for 19%, and diseases of the respiratory system for nearly 10%.[37]

[35] E. Arias, United States life tables, 2002, *NVSR*, vol. 53, no. 6, Nov. 10, 2004, based on: (1) R.N. Anderson, "Some trends and comparisons of United States life table data: 1900-1991," vol. 1, no. 3, 1999, and (2) I. Waldron, "Recent Trends in Sex Mortality Ratios for Adults in Developed Countries," *Social Science and Medicine* 36:451-62, 1993.

[36] United Nations, "Sex Differentials in Life Expectancy and Mortality in Developed Countries: an Analysis by Age Groups and Causes of Death from Recent and Historical Data," *UN Population Bulletin,* 1988;25:65-107.

[37] Note that these results are not surprising, as cardiovascular disease and neoplasms were the two leading causes of death in the total population.

In general, why is life expectancy longer for women? The answer, which is still being investigated, involves the complicated interplay of a host of biological, social, and behavioral conditions. In addition, it differs according to age and to the underlying disease and mortality profiles for men and women. At birth, boys have a clear advantage. In the United States, 104.9 boys were born for every 100.0 girls in 2003.[38] But, male mortality exceeds that of females in *every* age group and for most major causes of death, beginning in infancy and continuing through the oldest-old age groups. One researcher has suggested that the male advantage at birth is moderated by higher male mortality to "ensure that the number of men and women will be about the same at reproductive age."[39]

Biological Factors

It has long been argued that hormones play a role in longevity. As described by Desjardins,[40] the female hormone estrogen helps to eliminate "bad" cholesterol (LDL) and thus may offer some protection against heart disease.[41] In contrast, some say, testosterone, found in greater amounts in males, may make men more likely to engage in violence and risk-taking behavior, especially if reinforced by cultural influences.[42] Women may also gain an additional biological advantage because of their two X chromosomes. If a gene mutation occurs on one X, a woman's second X chromosome may be able to compensate. In comparison, genes on men's sole X chromosome may be expressed, even if they are deleterious without compensation.

Stindl,[43] however, argues that these classic biological explanations do not withstand critical analysis.[44] He offered an alternative hypothesis that has not yet been subject to long-term scientific scrutiny. He asserts that a strong positive correlation has been reported between sexual size dimorphism (SSD)[45] and male-based mortality, with men being the larger/taller sex globally. A larger body requires more cell doublings, especially due to the ongoing regeneration of tissues over a lifetime. Accordingly, the replicative history of male cells might be longer than that of female cells, resulting in the exhaustion of the regeneration potential and the early onset of age-associated diseases predominantly in males. The underlying mechanism is the gradual erosion of chromosome ends (telomeres). Two recent studies confirm that men do have shorter telomeres than women at the same ages. Numerous studies also demonstrate links between chronic stress

[38] National Center for Health Statistics (NCHS), "Births, Final Data for 2003," *NVSR*, vol. 54, no. 2, Sept. 8, 2005.

[39] B. Desjardins, "Ask the Experts," *Scientific American*, December 2004, vol. 291, issue 6, p. 118.

[40] Ibid.

[41] See W.R. Hazzard, "Biological Basis of the Sex Differential in Longevity," *Journal of the American Geriatrics Society*, vol. 34, 1986, p. 455, who argued that the sex differential in sex hormone levels gives rise to the sex differential in lipoprotein metabolism which in time (given our lifestyle) contributes to the sex differential in atherosclerosis and this in turn to sex differentials in longevity.

[42] I. Waldron, "Sex Differences in Human Mortality: the Role of Genetic Factors," *Social Sciences and Medicine*, vol. 17, no. 6, pp. 321-333.

[43] R. Stindl, "Tying it All Together: Telomeres, Sexual Size Dimorphism and the Gender Gap in Life Expectancy," *Medical Hypotheses*, 2004:62, pp. 151-154.

[44] Stindl shows that estrogen levels in postmenopausal women are virtually identical to estrogen levels in males and can hardly explain the discrepancy. He notes that testosterone got its bad reputation from one outdated study on a non-representative sample of men. And, since it's unlikely that mutations in genes on the X chromosome are involved in all age-related diseases and that mutated versions of these genes occur in all men, the model might be of academic value only.

[45] In biology, a dimorphism refers to having two different distinct forms of individuals within the same species or two different distinct forms of parts within the same organism. Sexual dimorphism is a common case, which refers to the fact that the two sexes have different shapes, sizes, etc. from each other.

and indices of poor health, including risk factors for cardiovascular disease and poorer immune function.[46]

Behavioral and Social Differences

Many researchers believe that behavioral and social factors also contribute significantly to the sex differentials observed between men and women. Women's social status and life conditions (such as the hardships associated with childbirth) may have nullified American women's biological advantage at the beginning of the 20th century but are no longer major factors in gender differentials in life expectancy in the United States, though these explanations are still relevant in a number of other countries. Higher male mortality rates have been attributed to greater male exposure to specific risk factors, such as alcohol consumption and occupational hazards. Life expectancy in Russia, for instance, fell by 6.3 years for Russian men during the period 1990 to 1995—a level of decline that was unprecedented both in Russia and in other industrialized countries. In investigating the cause of the sudden drop, a team of researchers from the London School of Economics and the Russian Academy of Sciences observed that excessive alcohol consumption contributed both directly and indirectly to the marked increases in deaths from fatal events (e.g. accidents, injuries, suicides, poisonings) and in deaths from cardiovascular disease.[47]

The most cited behavioral contributor to higher male mortality rates in the United States—and the subject of considerable research interest—has been the greater male exposure to cigarette smoking. Smoking patterns are an obvious place to look for an explanation of sex mortality differences because the health risks are high and long-lasting; large fractions of the population have engaged in the habit; and smoking patterns differ between the sexes.[48] More specifically, women's uptake of smoking lagged behind that of men.[49] In the 1970s, when the sex differential in mortality was increasing, cigarette smoking was implicated.[50] Now, as the sex differential is narrowing, a new body of research is evaluating the role of cigarette smoking in explaining the trend. Pampel,[51] for instance, documented that the rate of decline in female mortality in the United States has slowed since 1980 or so, while that of males has returned to its earlier trend of relatively rapid improvement—thus resulting in a narrowing life expectancy differential by gender. He concludes that smoking behavior lies behind the changing pace of mortality decline not only in the United States, but also in 20 other industrial nations. Extending Pampel's analysis, Lee showed that the rate of decline for deaths *not* associated with smoking was actually faster for women (than men) while death rates associated with smoking actually increased for women while decreasing for men.[52] Preston and Wang[53] demonstrate that changes in sex mortality differences in the United States have been structured on a cohort rather than a period basis, and that the cohort

[46] E.S. Epel and colleagues, "Accelerated Telomere Shortening in Response to Life Stress," *PNAS*, vol. 101, no. 49, Dec. 7, 2004.

[47] D. Leon, M. McKee, L. Chenet, Adult Mortality in Russia, at http://www.lshtm.ac.uk/ ecohost/projects/mortality-russia.htm#alcconsump, accessed Aug. 11, 2006.

[48] I. Waldron, 1986, "The Contribution of Smoking to Sex Differences in Mortality," *Public Health Reports* 101:163-173.

[49] Pampel, 2002.

[50] See, for instance, (1) S.H. Preston, 1970. "Older Male Mortality and Cigarette Smoking: A Demographic Analysis", Institute for International Studies, Univ. Of California, Berkeley and (2) R.D. Rutherford, 1975. "The Changing Sex Differential in Mortality," Westport, Conn.: Greenwood Press.

[51] Pampel, 2002.

[52] Lee, 2002.

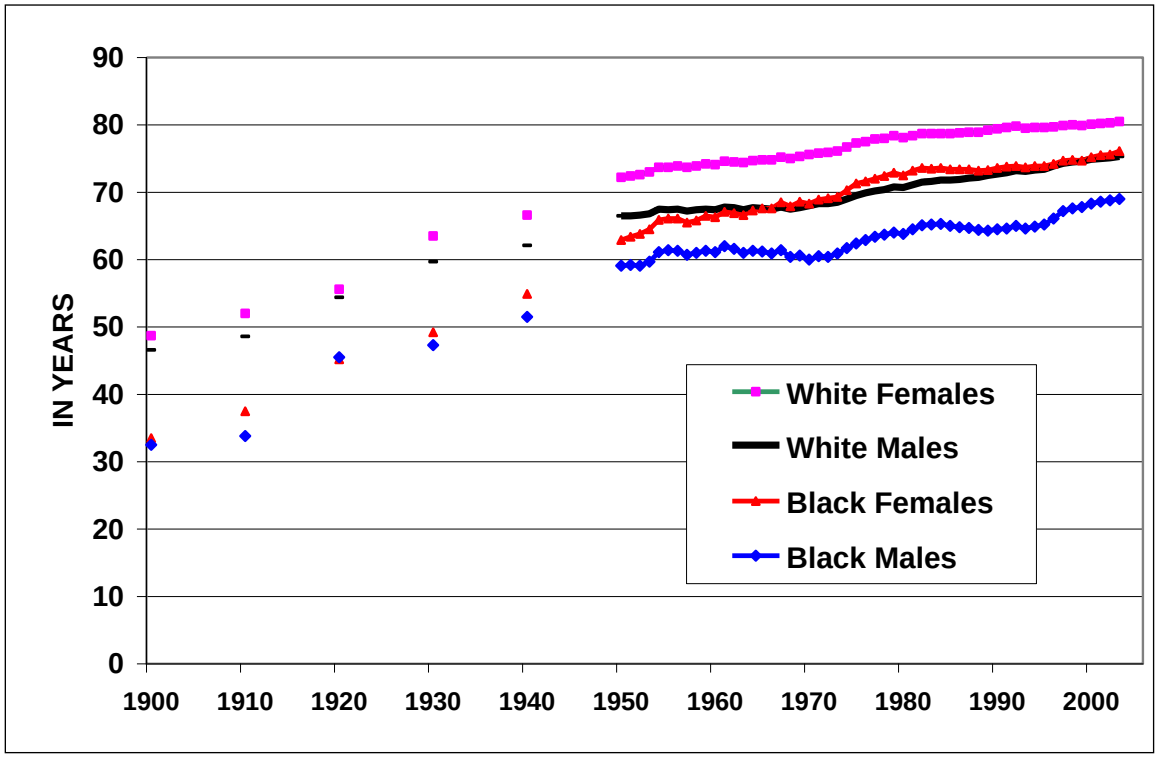
[53] Preston and Wang, 2005.

imprint is closely related to histories of cigarette smoking. Allowance for the smoking histories of cohorts significantly affects the assessment of mortality trends: national mortality levels would have declined more rapidly in the absence of smoking, and they are likely to decline more rapidly in the future as smoking recedes.

Race Differentials[54]

Life expectancy at birth for whites significantly exceeded that for blacks at the turn of the 20th century (see **Figure 2** and **Appendix B Table B-1**). At that time, the expected longevity of a white newborn girl exceeded that of a black newborn girl by about 16.0 years (with longevity measured at 51.1 years vs. 35.0 years, respectively). For newborn boys, the white advantage was 15.7 years (48.2 years vs. 32.5 years).

Figure 2. Trends in Life Expectancy at Birth, By Race and Sex, 1900 to 2003



Source: For 1900 to 2002, CRS compilation from National Center for Health Statistics (NCHS), *National Vital Statistics Reports*, vol. 53, no. 6, Nov. 10, 2004. For 2003, NCHS, *National Vital Statistics Reports*, vol. 54, no. 14, Apr. 19, 2005.

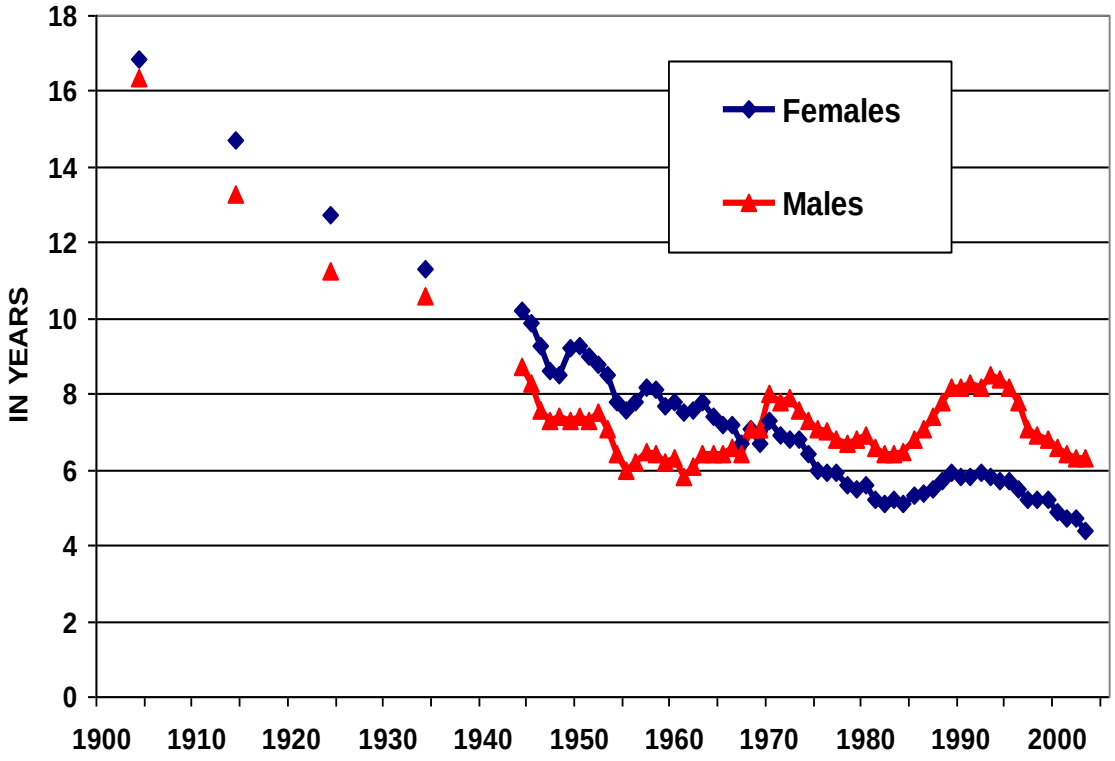
Notes: Later year estimates are more reliable than those of the early 20th century.

The gap between whites and blacks in average longevity declined significantly over the past century (**Figure 3**). For *females*, the improving situation for black women relative to their white counterparts was dramatic and mostly consistent throughout the century. From the height of the differential in 1904—when white women survived, on average, 17.9 years longer than black women—the gap fell to 4.4 years in 2003.

[54] This section considers only the differentials between blacks and whites, as these are the main categories available in the NCHS life table publications that this analysis is based on.

A significant reduction in the life expectancy gap between American white and black *men* was also observed over the 20th century. From its height of 17.8 years in 1904, the differential had fallen to 6.3 years in 2003. The improvement was most rapid in the first six decades of the past century. Since the mid-1950s, however, improvements for males have stagnated in the range of roughly 6.0 to 8.5 years. While the male gap has been falling over the past decade, this trend obscures the fact that the differential had already been at or near this level for most of the mid-1950s to mid-1960s. The gap in 1961 was narrower than that observed today—at that time, the gap between white and black men was 5.8 years (as compared to 6.3 now). Factors that contribute to the differential are discussed in later sections of this report.

Figure 3. Differences in Life Expectancy at Birth Between Whites and Blacks, by Sex, 1900-2003



Source: For 1900-2002, CRS computation based on, NCHS, United States Life Tables, vol. 53, no. 6, Nov 10, 2004. For 2003, NCHS, Deaths: Final Data for 2003, vol. 54, no. 13, Apr. 19, 2006.

Notes: Later year estimates are more reliable than those of the early 20th century.

In summary, mortality rates in the United States have declined dramatically over the past century. Black persons, however, still live, on average, 5.3 fewer years than their white counterparts. In 2003, the most recent year for which we have official data, the highest life expectancy was observed for white females, who will live, on average, 80.5 years. The values for black females and white males are quite similar to each other—76.1 years and 75.3 years, with black females having the slight advantage. Of the four race-sex groups considered, black males have the shortest average longevity—69.0 years. Within-sex groupings, whites have the advantage for both females and males.

What accounts for the higher mortality, and subsequent lower life expectancy for blacks, and especially for black men in the United States? This has been a subject of research by medical and social scientists for at least a century, and the issue stands at the heart of the current public health agenda in the United States.[55] One of the two primary goals of *Healthy People 2010* is to eliminate health disparities.

Mortality from most, but not all, causes of death are higher for blacks, and a number of researchers have investigated which specific diseases contribute most to life expectancy differences between the races. Wong and colleagues,[56] for instance, recently calculated potential years of life lost related to specific causes of deaths for blacks and whites in the United States (**Table 5**).

Table 5. Racial Disparity in Potential Life Years Lost

(Percent contribution of specific cause of death to overall racial disparity)

Cause of death	% of Disparity	Cause of death	% of Disparity
Cardiovascular disease	34.0	Infection	21.1
Ischemic heart disease	5.5	Tuberculosis	0.6
Cerebrovascular stroke	2.8	Pneumonia	5.2
Hypertension	15.0	Viral hepatitis	0.1
Congestive heart failure	0.1	Sepsis	3.4
Other arteriosclerotic	5.6	HIV	11.2
Other CVD disease	5.0	Other infections	0.6
Cancer	3.4	All trauma	10.7
Lung disease	(5.8)	Motor vehicle accident	2.5
Diabetes mellitus	8.5	Suicide	(2.5)
Liver disease	2.6	Homicide	8.5
Alcohol-related diseases	0.8	Other accidents	2.2
Renal disease	4.0	All other causes	19.8
Rheumatologic diseases	1.4	Total	100.0

Source: CRS adaptation from M.D. Wong and colleagues, "Contribution of Major Diseases to Disparities in Mortality," *New England Journal of Medicine*, vol. 347, no. 20, Nov. 14, 2002.

Notes: Calculations adjust for differences between races in age, sex, and level of education; numbers in parentheses show causes-of-death for which blacks fare better than whites; and these estimates are for persons dying before the age of 75 years though the authors state that all results were similar when potential life-years lost before the age of 85 years were examined. Note that trends and racial differentials at the oldest ages (85 and older) differ as black mortality rates are lower than those of whites for both men and women in official mortality data from NCHS. See **Appendix B Table B-2**.

As seen in **Table 5**, when considering the major categories of disease, deaths from cardiovascular disease contributed most to the racial disparity in mortality from any cause (34.0%), followed by infection (21.1%), and trauma (10.7%).

[55] U.S. Dept. of Health and Human Services, *Tracking Healthy People 2010*, 2000.

[56] M.D. Wong and colleagues, "Contribution of Major Diseases to Disparities in Mortality," *New England Journal of Medicine*, vol. 347, no. 20, Nov. 14, 2002.

When looking at specific diseases, the leading sources of the disparity were largely preventable causes of premature death—hypertension (which contributed 15.0% to the disparity), followed by HIV disease (11.2%), diabetes (8.5%), and homicide (8.5%). Note that blacks had a lower mortality risk from respiratory diseases (lung disease), suicide, and certain types of cancer (breast, colon, uterus or ovary, bladder or kidney, and leukemia or lymphoma; figures are in the original source but are not shown in table). These results are consistent with findings from other studies,[57] and are said to show that "most of the influential diseases are ones in which the rates vary based on avoidable risks such as smoking, exposure to HIV, and obesity. [And,] this adds to the credibility of public-health interventions aimed at reducing the exposure to these risk factors."[58] The results may also offer hope for the elimination of racial disparities in health.[59]

Beyond describing gross health disparities, scientific inquiry has shifted to explaining the underlying factors that account for these differences in health outcomes. Understanding these underlying causes requires disentangling the complex web of factors connecting the nexus among race, socioeconomic status, behavioral factors, and health.[60] Some have argued that, if pertinent differences between whites and blacks in their underlying social, demographic, familial, and economic circumstances were eliminated, racial differences in mortality would be significantly reduced.[61,62]

Socioeconomic arguments cite the consequences of lifelong poverty. Relevant factors include both early-life differences, such as birth weight and childhood nutrition, and mid-life variables (such as access to employer-provided health insurance, the strain of physically demanding work, and exposure to a broad range of toxins, both behavioral (e.g., smoking) and environmental (e.g., workplace exposures). Over the life cycle, these factors combine to increase the demand for health care, while potentially limiting consumption of necessary health services. In late life, these factors may affect the age of onset of both morbidity and disability, the severity of symptoms, and ultimately the age at, and cause of death.[63]

In addition, Martin and Soldo[64] note that there are differences between racial groups in norms regarding not only lifestyle and self-care behaviors, but also in access to health care providers and treatment compliance. Moreover, the experience of racial discrimination may have adverse psychological and physiological effects, in addition to limiting the quantity and quality of health care received. Some of these factors that contribute to the racial gap in life expectancy will be discussed briefly in the following paragraphs.

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[57] See, for instance, R.G. Rogers, "Living and Dying in the U.S.A.: Sociodemographic Determinants of Death Among Blacks and Whites," *Demography*, vol. 29, no. 2, May 1992, pp. 287-303.

[58] P. Bach (Memorial Sloan-Kettering Cancer Center), cited in D. Lawrence, "Which Diseases Contribute to Life-Expectancy Differences Between Races?," *The Lancet*, vol. 360, Health Module, Nov. 16, 2002, p. 1571.

[59] Ibid, p. 1571.

[60] J.P. Smith and R.S. Kington, "Race, Socioeconomic Status, and Health in Late Life," in *National Research Council, Racial and Ethnic Differences in the Health of Older Americans*, 1997.

[61] Ibid.

[62] R.G. Rogers, R.A. Hummer, and C.B. Nam, "Living and Dying in the U.S.A.: Behavioral, Health, and Social Differentials of Adult Mortality," *Academic Press*, 2000.

[63] L.G. Martin and B.J. Soldo, "Introduction," in R.A. Hummers, M.R. Benjamins, R.G. Rogers, eds., *Racial and Ethnic Differences in the Health of Older Americans*, National Research Council (Washington: The National Academies Press, 1997) (hereafter: NRC, 1997).

[64] Ibid.

Economic and Social Factors

In general, as income increases, mortality decreases, because high income provides access to high-quality health care, diet, housing, and health insurance. Black households had the lowest median income in the United States in 2003. Their median money income was about $30,000, which was 62% of the median for non-Hispanic White households (about $48,000).[65] Poverty rates among African Americans are persistently higher than those of non-Hispanic whites. In 2003, 24.4% of blacks were poor, compared to 8.2% of non-Hispanic whites.[66]

Recent research also highlights the enduring effects of education. Increased education appears to lower the risks for some chronic diseases—most notably, coronary heart disease (which is the leading cause of death in the United States)—while retarding the pace of disease progression for other conditions.[67] In 2003, the proportion of both blacks and non-Hispanic whites who had a high school diploma (of persons in the population aged 25 and over) reached record highs but at different levels for the two racial groups—80% and 89%, respectively. The gap in educational attainment is also apparent among recipients of bachelor's degrees—30% of non-Hispanic whites aged 25 and older had attained a four-year college degree compared to 17% of blacks.[68]

Marriage is also a socioeconomic determinant that is related to health outcomes. Married people consistently exhibit lower levels of mortality than those who are not married. Marriage acts to select healthy individuals, but it also enhances social integration and encourages healthful behaviors.[69] Race differences in marital and cohabitational stability are substantial, and may be increasing over time. About 91 percent of white women born in the 1950s are estimated to marry at some time in their lives, compared with 75% of black women. Black married couples are more likely to break up than white married couples, and black divorcees are less likely to remarry than white divorcees.[70] The degree of attachment to marriage among black Americans is similar to that of white Americans as measured by attitudes toward marriage. One explanation offered by some researchers for the lower proportion of time spent in marriage among black Americans is the idea of a "marriage squeeze," in which the "marriageable pool" of black men is low due to high rates of joblessness, incarceration, and mortality. Employed men are more likely than unemployed men to marry.[71]

Behavioral Risk Factors

Prolific research over the past two decades has confirmed the link between certain diseases and health outcomes and various health-damaging (such as smoking, alcohol abuse) and health-promoting (exercise, low-fat diet) behaviors. And, some researchers have explored the extent to

[65] C. DeNavas-Walt, B.D. Proctor, and R.J. Mills, *Income, Poverty, and Health Insurance Coverage in the United States, 2003*, U.S. Census Bureau, Current Population Reports, P60-226, 2004. Note that the distribution of household income is influenced by many factors, such as the number of earners and household size. If a comparison is made instead on per capita income, the median money income for whites is $24,442 compared to $15,583 for blacks.

[66] CRS Report 95-1024, *Trends in Poverty in the United States*, by Thomas Gabe.

[67] L.G. Martin and B.J. Soldo, "Introduction," in NRC, 1997.

[68] N. Stoops, *Educational Attainment in the United States, 2003, Population Characteristics*, U.S. Census Bureau, Current Population Reports, P20-550.

[69] R.G. Rogers, "Living and Dying in the U.S.A.: Sociodemographic Determinants of Death Among Blacks and Whites," *Demography*, vol. 29, no. 2, 1992, pp. 287-303.

[70] M.D. Bramlett, and W.D. Mosher, "Cohabitation, Marriage, Divorce, and Remarriage in the United States," NCHS, *Vital Health Stat* 23(22), 2002.

[71] Ibid.

which health-damaging and health-promoting behaviors explain black-white differences in health status. Berkman and Mullen,[72] for instance, found that, despite greater apparent concern on the part of blacks than whites about their health, blacks do not consistently adopt more beneficial behaviors than whites. Older blacks engage in less physical activity and are more likely to be obese (especially women), but they are less likely to consume alcohol than whites. Racial differences in smoking patterns are complex, with older blacks less likely to have smoked but, if they have, less likely to have quit. Lack of exercise and obesity are associated with hypertension and diabetes, both of which have been reported to be twice as common among blacks than among whites.[73]

Access to Health Care

The United States is the only developed country in the world that does not have national health coverage,[74] and significant numbers of Americans, and especially African Americans, do not have sufficient health care coverage. More specifically, 21.0% of blacks under age 65 and 12.9% of whites of the same age lacked private health insurance in 2003.[75]

Beyond health insurance, Chandra and Skinner[76] argue that there is differential access to health services in the United States, especially because of geographic variation in treatment and outcome patterns. Minorities tend to seek care from different hospitals and from different physicians than non-Hispanic whites, in large part a reflection of the general spatial distribution of the United States population with concentrations of minorities in certain hospital referral regions.

Genetic Factors

Some research suggests that there are race-related genetic factors both for predisposing conditions, such as hypertension and diabetes mellitus, and for life-threatening conditions, such as aplastic anemia. As recently noted by the National Research Council, however, "Probably no aspect of the debate about the causes of racial differences in health is potentially more sensitive than the discussion about the extent to which genetic factors are in any way responsible. There are numerous historical examples of scientific mischief in the support of racism."[77] Those in favor of using race assert that there is a useful degree of association between genetic differences and racial classifications, so that the use of race as a research variable is warranted. Opponents, however, argue that bundling the population into four or five categories based on skin color or other traits is not a useful way to summarize genetic variation when we know that there are at

[72] L.F. Berkman and J.M. Mullen, "How Health Behaviors and the Social Environment Contribute to Health Differences between Black and White Older Americans," in NRC, 1997. See also, M.A. Winkleby, and C. Cubbin, "Racial/Ethnic Disparities in Health Behaviors: a Challenge to Current Assumptions," in N.B. Anderson, R.A. Bulatao, and B. Cohen, eds., *Critical Perspectives on Racial and Ethnic Differences in Health in Late Life*, National Research Council, Panel on Race, Ethnicity, and Health in Later Life, Committee on Population, Division of Behavioral and Social Sciences and Education (Washington: The National Academies Press, 2004), pp. 310-352 (hereafter: NRC, 2004).

[73] L.G. Martin and B.J. Soldo, "Introduction," in NRC, 1997.

[74] B. Cohen, "Introduction," in NRC, 2004, p. 16.

[75] CRS Report 96-891, *Health Insurance Coverage: Characteristics of the Insured and Uninsured Populations in 2007*, by Chris L. Peterson and April Grady.

[76] A. Chandra and J.S. Skinner, "Geography and Racial Health Disparities," in NRC, 2004, pp. 604-642.

[77] B. Cohen, "Introduction," in NRC, 2004, p. 9.

least 15 million genetic polymorphisms in humans, of which an unknown number underlie variation in (normal and) disease traits.[78]

Research in this area is still in its infancy and tends to reflect two ways that genes may be relevant to the study of health differentials.[79] *First*, there are a small number of conditions with single-gene disorders in populations that have descended from a relatively small number of people and that remain endogamous[80] (an example is Tay-Sachs Disease among Ashkenazi Jews). *Second*, genes may be relevant to the study of health differentials through environmental factors, which may vary by racial or ethnic group, and which might interact with genotype to produce different outcomes for different groups.

Conclusion

One of the most important public health achievements of the 20th century in the United States was the dramatic and widespread increase in life expectancy that occurred over the past century in the United States—first as a result of the control of the infectious and parasitic diseases that had plagued mostly infants and children in the early part of the century, and later because of medical advances that led to large decreases in adult mortality, especially from two of the most prevalent causes of death—cardiovascular diseases and cerebrovascular diseases.

A consequence of the improved survival, coupled with declining fertility rates, is that the United States is in the midst of a profound demographic change: rapid population aging, a phenomenon that is replacing the earlier "young" age-sex structure with that of an older population.[81] Hastened by the retirement of the "Baby Boom" generation (the cohort born between 1946 and 1964), the inexorable demographic momentum will have important implications for a large number of essential economic and social domains, including work, retirement, and pensions, wealth and income security, and the health and well-being of the aging population.

Whether the life expectancy improvements will continue is the subject of intense debate. The Social Security Administration (SSA) assumes that the rate of future mortality improvements will be nearly the same as for the last century—a little more than 0.7% annually—while asserting that it may be difficult to match the accomplishments of the past century, especially in light of increasing obesity, declining levels of exercise, and the introduction of new scourges, such as AIDS, SARS, antibiotic resistant microbes.[82] Some demographers, on the other hand, feel that such projections are pessimistic, and argue, based on historical trends and evidence from other developed countries, that American survival will be longer than that projected by SSA.[83] The outcome of the debate has important implications for determining the number of future beneficiaries and ultimately the financial soundness of the Social Security and the Medicare programs.

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[78] E.G. Burchard and colleagues, "The Importance of Race and Ethnic Background in Biomedical Research and Clinical Practice," *New England Journal of Medicine*, vol. 348, no. 12, pp. 1170-1175, 2003.

[79] See R.S. Cooper, "Genetic Factors in Ethnic Differences in Health," in NRC, 2004, pp. 269-309.

[80] Marriage within a specific group as required by custom or law.

[81] CRS Report RL32701, *The Changing Demographic Profile of the United States*, by Laura B. Shrestha.

[82] Testimony of SSA S.C. Goss, chief actuary, in U.S. Congress, Senate, Special Committee on Aging, *The Future of Human Longevity: How Important Are Markets and Innovation?*, hearings, 108th Congress, first session, June 3, 2003, S.Hrg. 108-192 (Washington: GPO, 2003).

[83] Testimony of J.W. Vaupel, director, Max Planck Institute for Demographic Research, in U.S. Congress, Senate, Special Committee on Aging, *The Future of Human Longevity: How Important Are Markets and Innovation?*, hearings, 108th Congress, first session, June 3, 2003, S.Hrg. 108-192 (Washington: GPO, 2003).

This report also highlights the continuing differentials in life expectancy by race and sex in the United States, with black males continuing to be the most disadvantaged group on this measure. Life expectancy at birth in 2003 for black males measured 69.0 years, falling short of the comparable figure for white males by 6.3 years. The gap between black and white men has remained relatively stagnant since the mid-1950s.

The sources of the racial disparities in life expectancy are complex and require disentangling the complex web of factors connecting the nexus among race, socioeconomic status, behavioral factors, and health. Differences exist on a wide variety of important variables including lifetime income and wealth, marriage patterns, birth weight and childhood nutrition, access to employer-provided health insurance, the strain of physically demanding work, exposure to toxins, risky behaviors (such as smoking, high saturated diet), adherence to preventative health measures (such as maintaining a healthy weight, exercise), and access to and quality of health care. In addition, the experience of racial discrimination may have adverse psychological and physiological effects, in addition to limiting the quantity and quality of health care received.[84]

Recent research, however, that shows that the leading specific diseases that are the main sources of the racial disparity in life expectancy are largely preventable causes of premature death offers hope that public-health interventions can reduce the racial disparities. Specifically, the leading causes of the racial disparity were hypertension (which contributed 15.0% to the disparity), followed by HIV disease (11.2%), diabetes (8.5%), and homicide (8.5%) in a recent analysis.[85]

[84] L.G. Martin and B.J. Soldo, "Introduction," in NRC, 1997.

[85] M.D. Wong and colleagues, "Contribution of Major Diseases to Disparities in Mortality," *New England Journal of Medicine*, vol. 347, no. 20, Nov. 14, 2002.

Appendix A. Glossary of Terms

Age-adjustment.	Procedure used to compare risks of two or more populations at one point in time or one population at two or more points in time. Age-adjusted rates eliminate differences in observed (crude) rates that result from age differences in population composition.
Age-specific rate.	A rate that relates a given demographic event at a specific age (or age group) to the corresponding at-risk population in the same age (or age group). For example, the age-specific death rate in a particular population for persons aged 40-44 = [(Deaths to persons aged 40-44)/(Total population aged 40-44)] * 1000.
Aging (of population).	A process in which the proportion of adults and elderly increase in a population, while the proportion of children and adolescents decrease. This process results in a rise in the median age of the population.
At-risk population.	The persons to whom an event can potentially occur. In the form of the population at the middle of a given period, such as a year, it is used as an approximation of "person-years lived." *See also age-specific rate*.
Birth cohort.	Members of a population born in a given period (e.g., year 1900, time period 1946-1964, 2002).
Cohort.	A group of people who experience the same demographic event during a particular period of time such as their year of birth. Cohorts are typically defined on the basis of an initiating signal event (e.g., birth) but they can also be defined on the basis of a terminating signal event (e.g., death).
Cohort life expectancy.	A method to calculate life expectancy using death rates not from a single year, but from the series of years in which the individual will actually reach each succeeding age if he or she survives.
Crude rate.	A rate that relates a demographic event to the total population and makes no distinction concerning different exposure levels to the event.
Death.	The permanent disappearance of all evidence of life at any time after a live birth has taken place. The loss of a member of a population, as recorded by a death certificate.
Death rate.	The number of deaths per 1,000 persons in the population in a given year. Also referred to as the crude death rate. See also *age-specific rate*.
Death Registration Area.	In the United States, the states and local governments complying with federal standards for the registration of deaths. It was established in 1900 and by 1933 encompassed all states.
Expectation of life.	A statistical measure of the average amount of time (usually measured in years) remaining for a person or group of persons before death, usually estimated using a life table.
Life expectancy.	An estimate of the *average* number of additional years a person could expect to live if the age-specific death rates for a given year prevailed for the rest of that person's life. Also refers to the average number of years of life remaining to a group of persons who reached a given age, as calculated from a life table. Most commonly refers to life expectancy at birth; can also be calculated for other ages. See also *Cohort life expectancy* and *Period life expectancy*.
Life span.	The maximum age that human beings could attain under optimum conditions. The extreme upper limits of human life.
Life table.	A statistical model composed of a combination of age-specific mortality rates for a given population. A period life table is constructed by using mortality and age data from a single point in time; a generational life table is based on the mortality of an actual birth cohort followed over time (to its extinction).
Life table functions.	The fundamental elements of a life table include number surviving to a given age, the number of deaths to those surviving to a given birthday before they reach a subsequent birthday, the probability of dying before reaching a subsequent birthday for those who survived to a given

	birthday, the number alive between two birthdays, and the years of life remaining for those who survive to a given birthday (including birth).
Longevity.	Length of life; life span. "Average longevity" usually refers to life expectancy.
Mean age at death.	The arithmetic mean age at death of the reported deaths in a given year. In the life table, the mean age at death of life table deaths is equal to life expectancy at birth in the same life table.
Morbidity.	The frequency of disease, illness, injuries, and disabilities in a population.
Mortality.	A general term for the incidence of deaths in a population.
Period life expectancy.	A method to calculate life expectancy for a given year using the actual or expected death rates at each age for that year. It is a useful summary statistic for illustrating the overall level of the death rates experienced in a single year. It is closely related to the age-sex-adjusted death rate. The period life expectancy for a particular year may be viewed as the expected remaining life at a selected age only if it is assumed that will be no change in death rates after that year.
Period life table.	A life table based on mortality data collected at a given point in time (frequently one year) for a given population.
Person-years lived.	The total number of years (and fractions thereof) lived by a given population or population segment during a given period of time. It is approximated by computing the product of (1) the number of persons in the population or population segment and (2) the amount of time in years (and fractions thereof) lived by these persons during the time in question. *See also: at-risk population and life table.*
Population.	The "inhabitants" of a given area at a given time.
Population projection.	The numerical outcome of a particular set of implicit and explicit assumptions regarding future values of the components of population change for a given area in combination with an algorithm. Strictly speaking, it is a conditional statement about the size of a future population (often along with its composition and distribution).
Potential life years lost.	See *years of potential life lost.*
Projection.	See *Population projection*.
Race.	In theory, classification of the members of a population in terms of biological ancestry. In demographic practice, classification of the members of a population in terms of socially constructed definitions of membership in categories in which skin color or other characteristics, including national ethnic affiliations, may be the basis of assignment by census or survey enumerators or by self-enumeration. In the United States decennial census, persons are self-identified by race.
Sex.	Classification of the population into the categories of male and female.
Survival.	Primarily a condition where an individual or group remains alive after a specified interval.
Survival rate.	A rate expressing the probability of survival of a population group, usually an age group, from one date to another and from one age to another. Can be based on life tables or two censuses.
Years of potential life lost.	Measure of the relative impact of various diseases and lethal forces on society, computed by estimating the years that people would have lived if they had not died prematurely from injury or disease. Sometimes referred to as *potential life years lost*.

Source: CRS compilation based on: (1) J.S. Siegel and D.A. Swanson, eds. *The Methods and Materials of Demography*, 2nd ed. Elsevier Academic Press, 2004; (2) S.H. Preston, P. Heuveline, and M. Guillot, *Demography: Measuring and Modeling Population Processes*, Blackwell Publishing, 2001; (3) A. Haupt and T.T. Kane. *Population Reference Bureau's Population Handbook*, 4th International Edition, Wash., DC, Population Reference Bureau, 1998; (4) National Center for Health Statistics, *Health, United States, 2004, With Chartbook on Trends in the Health of Americans*, Hyattsville, MD, 2004, Appendix 2; (5) Social Security Administration, 2006 Annual Report of the Trustees of the Federal Old-Age and Survivors Insurance and Disability Trust Funds, May 1, 2006, at http://www.ssa.gov/ OACT/TR/TR06/tr06.pdf, table V, A3.

Appendix B. Detailed Life Expectancy Tables

Table B-1. Life Expectancy at Birth, by Race and Sex: 1900-2003

(in years)

	All Races			White			Black[a]		
Yr. / Sex	Both	M	F	Both	M	F	Both	M	F
United States[b]									
2003	77.5	74.8	80.1	78.0	75.3	80.5	72.7	69.0	76.1
2002	77.3	74.5	79.9	77.7	75.1	80.3	72.3	68.8	75.6
2001	77.2	74.4	79.8	77.7	75.0	80.2	72.2	68.6	75.5
2000	77.0	74.3	79.7	77.6	74.9	80.1	71.9	68.3	75.2
1999	76.7	73.9	79.4	77.3	74.6	79.9	71.4	67.8	74.7
1998	76.7	73.8	79.5	77.3	74.5	80.0	71.3	67.6	74.8
1997	76.5	73.6	79.4	77.2	74.3	79.9	71.1	67.2	74.7
1996	76.1	73.1	79.1	76.8	73.9	79.7	70.2	66.1	74.2
1995	75.8	72.5	78.9	76.5	73.4	79.6	69.6	65.2	73.9
1994	75.7	72.4	79.0	76.5	73.3	79.6	69.5	64.9	73.9
1993	75.5	72.2	78.8	76.3	73.1	79.5	69.2	64.6	73.7
1992	75.8	72.3	79.1	76.5	73.2	79.8	69.6	65.0	73.9
1991	75.5	72.0	78.9	76.3	72.9	79.6	69.3	64.6	73.8
1990	75.4	71.8	78.8	76.1	72.7	79.4	69.1	64.5	73.6
1989	75.1	71.7	78.5	75.9	72.5	79.2	68.8	64.3	73.3
1988	74.9	71.4	78.3	75.6	72.2	78.9	68.9	64.4	73.2
1987	74.9	71.4	78.3	75.6	72.1	78.9	69.1	64.7	73.4
1986	74.7	71.2	78.2	75.4	71.9	78.8	69.1	64.8	73.4
1985	74.7	71.1	78.2	75.3	71.8	78.7	69.3	65.0	73.4
1984	74.7	71.1	78.2	75.3	71.8	78.7	69.5	65.3	73.6
1983	74.6	71.0	78.1	75.2	71.6	78.7	69.4	65.2	73.5
1982	74.5	70.8	78.1	75.1	71.5	78.7	69.4	65.1	73.6
1981	74.1	70.4	77.8	74.8	71.1	78.4	68.9	64.5	73.2
1980	73.7	70.0	77.4	74.4	70.7	78.1	68.1	63.8	72.5
1979	73.9	70.0	77.8	74.6	70.8	78.4	68.5	64.0	72.9
1978	73.5	69.6	77.3	74.1	70.4	78.0	68.1	63.7	72.4
1977	73.3	69.5	77.2	74.0	70.2	77.9	67.7	63.4	72.0
1976	72.9	69.1	76.8	73.6	69.9	77.5	67.2	62.9	71.6
1975	72.6	68.8	76.6	73.4	69.5	77.3	66.8	62.4	71.3
1974	72.0	68.2	75.9	72.8	69.0	76.7	66.0	61.7	70.3

Yr.	All Races			White			Black[a]		
Sex	Both	M	F	Both	M	F	Both	M	F
1973	71.4	67.6	75.3	72.2	68.5	76.1	65.0	60.9	69.3
1972[c]	71.2	67.4	75.1	72.0	68.3	75.9	64.7	60.4	69.1
1971	71.1	67.4	75.0	72.0	68.3	75.8	64.6	60.5	68.9
1970	70.8	67.1	74.7	71.7	68.0	75.6	64.1	60.0	68.3
1969	70.5	66.8	74.4	71.4	67.7	75.3	64.5	60.6	68.6
1968	70.2	66.6	74.1	71.1	67.5	75.0	64.1	60.4	67.9
1967	70.5	67.0	74.3	71.4	67.8	75.2	64.9	61.4	68.5
1966	70.2	66.7	73.9	71.1	67.5	74.8	64.2	60.9	67.6
1965	70.2	66.8	73.8	71.1	67.6	74.8	64.3	61.2	67.6
1964	70.2	66.8	73.7	71.0	67.7	74.7	64.2	61.3	67.3
1963[d]	69.9	66.6	73.4	70.8	67.4	74.4	63.7	61.0	66.6
1962[d]	70.1	66.9	73.5	70.9	67.7	74.5	64.2	61.6	66.9
1961	70.2	67.1	73.6	71.0	67.8	74.6	64.5	62.0	67.1
1960	69.7	66.6	73.1	70.6	67.4	74.1	63.6	61.1	66.3
1959	69.9	66.8	73.2	70.7	67.5	74.2	63.9	61.3	66.5
1958	69.6	66.6	72.9	70.5	67.4	73.9	63.4	61.0	65.8
1957	69.5	66.4	72.7	70.3	67.2	73.7	63.0	60.7	65.5
1956	69.7	66.7	72.9	70.5	67.5	73.9	63.6	61.3	66.1
1955	69.6	66.7	72.8	70.5	67.4	73.7	63.7	61.4	66.1
1954	69.6	66.7	72.8	70.5	67.5	73.7	63.4	61.1	65.9
1953	68.8	66.0	72.0	69.7	66.8	73.0	62.0	59.7	64.5
1952	68.6	65.8	71.6	69.5	66.6	72.6	61.4	59.1	63.8
1951	68.4	65.6	71.4	69.3	66.5	72.4	61.2	59.2	63.4
1950	68.2	65.6	71.1	69.1	66.5	72.2	60.8	59.1	62.9
1949	68.0	65.2	70.7	68.8	66.2	71.9	60.6	58.9	62.7
1948	67.2	64.6	69.9	68.0	65.5	71.0	60.0	58.1	62.5
1947	66.8	64.4	69.7	67.6	65.2	70.5	59.7	57.9	61.9
1946	66.7	64.4	69.4	67.5	65.1	70.3	59.1	57.5	61.0
1945	65.9	63.6	67.9	66.8	64.4	69.5	57.7	56.1	59.6
1944	65.2	63.6	66.8	66.2	64.5	68.4	56.6	55.8	57.7
1943	63.3	62.4	64.4	64.2	63.2	65.7	55.6	55.4	56.1
1942	66.2	64.7	67.9	67.3	65.9	69.4	56.6	55.4	58.2
1941	64.8	63.1	66.8	66.2	64.4	68.5	53.8	52.5	55.3
1940	62.9	60.8	65.2	64.2	62.1	66.6	53.1	51.5	54.9
1939	63.7	62.1	65.4	64.9	63.3	66.6	54.5	53.2	56.0

Yr.	All Races			White			Black[a]		
Sex	Both	M	F	Both	M	F	Both	M	F
1938	63.5	91.9	65.3	65.0	63.2	66.8	52.9	51.7	54.3
1937	60.0	58.0	62.4	61.4	59.3	63.8	50.3	48.3	52.5
1936	58.5	56.6	60.6	59.8	58.0	61.9	49.0	47.0	51.4
1935	61.7	59.9	63.9	62.9	61.0	65.0	53.1	51.3	55.2
1934	61.1	59.3	63.3	62.4	60.5	64.6	51.8	50.2	53.7
1933	63.3	61.7	65.1	64.3	62.7	66.3	54.7	53.5	56.0
1932	62.1	61.0	63.5	63.2	62.0	64.5	53.7	52.8	54.6
1931	61.1	59.4	63.1	62.6	60.8	64.7	50.4	49.5	51.5
1930	59.7	58.1	61.6	61.4	59.7	63.5	48.1	47.3	49.2
1929	57.1	55.8	58.7	58.6	57.2	60.3	46.7	45.7	47.8
Death Registration States[e]									
1928	56.8	55.6	58.3	58.4	57.0	60.0	46.3	45.6	47.0
1927	60.4	59.0	62.1	62.0	60.5	63.9	48.2	47.6	48.9
1926	56.7	55.5	58.0	58.2	57.0	59.6	44.6	43.7	45.6
1925	59.0	57.6	60.6	60.7	59.3	62.4	45.7	44.9	46.7
1924	59.7	58.1	61.5	61.4	59.8	63.4	46.6	45.5	47.8
1923	57.2	56.1	58.5	58.3	57.1	59.6	48.3	47.7	48.9
1922	59.6	58.4	61.0	60.4	59.1	61.9	52.4	51.8	53.0
1921	60.8	60.0	61.8	61.8	60.8	62.9	51.5	51.6	51.3
1920	54.1	53.6	54.6	54.9	54.4	55.6	45.3	45.5	45.2
1919	54.7	53.5	56.0	55.8	54.5	57.4	44.5	44.5	44.4
1918	39.1	36.6	42.2	39.8	37.1	43.2	31.1	29.9	32.5
1917	50.9	48.4	54.0	52.0	49.3	55.3	38.8	37.0	40.8
1916	51.7	49.6	54.3	52.5	50.2	55.2	41.3	39.6	43.1
1915	54.5	52.5	56.8	55.1	53.1	57.5	38.9	37.5	40.5
1914	54.2	52.0	56.8	54.9	52.7	57.5	38.9	37.1	40.8
1913	52.5	50.3	55.0	53.0	50.8	55.7	38.4	36.7	40.3
1912	53.5	51.5	55.9	53.9	51.9	56.2	37.9	35.9	40.0
1911	52.6	50.9	54.4	53.0	51.3	54.9	36.4	34.6	38.2
1910	50.0	49.4	51.8	50.3	48.6	52.0	35.6	33.8	37.5
1909	52.1	50.5	53.8	52.5	50.9	54.2	35.7	34.2	37.3
1908	51.1	49.5	52.8	51.5	49.9	53.3	34.9	33.8	36.0
1907	47.6	45.6	49.9	48.1	46.0	50.4	32.5	31.1	34.0
1906	48.7	46.9	50.8	49.3	47.3	51.4	32.9	31.8	33.9
1905	48.7	47.3	50.2	49.1	47.6	50.6	31.3	29.6	33.1

Yr.	All Races			White			Black[a]		
Sex	Both	M	F	Both	M	F	Both	M	F
1904	47.6	46.2	49.1	48.0	46.6	49.5	30.8	29.1	32.7
1903	50.5	49.1	52.0	50.9	49.5	52.5	33.1	31.7	34.6
1902	51.5	49.8	53.4	51.9	50.2	53.8	34.6	32.9	36.4
1901	49.1	47.6	50.6	49.4	48.0	51.0	33.7	32.2	35.3
1900	47.3	46.3	48.3	47.6	46.6	48.7	33.0	32.5	33.5

Source: For historical data: CRS compilation from National Center for Health Statistics (NCHS), *National Vital Statistics Report*, United States Life Tables, 2002, Nov. 10, 2004, Table 12. For most recent year: NCHS, *National Vital Statistics Report*, Deaths: Final Data for 2003, Apr. 19, 2006.

Notes: Life expectancy at age 0 (at birth) measures the number of years that a newborn could expect to live, on average, if mortality trends in the year of birth were to continue for the rest of the newborn's life; For selected years, life table values shown are estimates; and beginning 1970, excludes deaths of nonresidents of the United States.

a. Prior to 1970, data for black population are not available. Data shown for 1900-1969 are for nonwhite population.

b. Alaska included in 1959 and Hawaii in 1960.

c. Deaths based on a 50% sample.

d. Figures by race in this year exclude data for residents of New Jersey.

e. Data for 1900-1928 are based on deaths in the "Death Registration States"; not the entire United States. The federal civil registration system began in 1900 with the setting up of the Death Registration Area. States were only admitted to the registration areas as qualification standards were met. Only 10 states and the District of Columbia were in the original death registration area of 1900; the number of states included increased with time.

Table B-2. Life Expectancy at Various Ages in 2003, by Sex and Race

(final data, *in years*)

	White Population			Black Population			Difference (White-Black)		
Age	All	M	F	All	M	F	All	M	F
0	78.0	75.3	80.5	72.7	69.0	76.1	5.3	6.3	4.4
1	77.4	74.8	79.9	72.7	69.1	76.0	4.7	5.7	3.9
5	73.5	70.9	76.0	68.9	65.3	72.2	4.6	5.6	3.8
10	68.5	66.0	71.0	63.9	60.3	67.2	4.6	5.7	3.8
15	63.6	61.0	66.1	59.0	55.4	62.3	4.6	5.6	3.8
20	58.8	56.3	61.2	54.2	50.7	57.4	4.6	5.6	3.8
25	54.1	51.6	56.3	49.6	46.3	52.6	4.5	5.3	3.7
30	49.3	46.9	51.5	45.0	41.8	47.8	4.3	5.1	3.7
35	44.5	42.2	46.6	40.4	37.3	43.1	4.1	4.9	3.5
40	39.8	37.6	41.9	36.0	32.9	38.6	3.7	4.5	3.3
45	35.2	33.1	37.2	31.6	28.7	34.1	3.6	4.4	3.1
50	30.8	28.8	32.6	27.6	24.8	29.9	3.2	4.0	2.7

	White Population			Black Population			Difference (White-Black)		
Age	**All**	**M**	**F**	**All**	**M**	**F**	**All**	**M**	**F**
55	26.5	24.6	28.1	23.8	21.2	25.9	2.7	3.4	2.2
60	22.3	20.6	23.8	20.2	17.9	22.1	2.1	2.7	1.7
65	18.5	16.9	19.8	17.0	14.9	18.5	1.5	2.0	1.3
70	14.9	13.5	16.0	14.0	12.1	15.3	0.9	1.4	0.7
75	11.7	10.5	12.6	11.4	9.8	12.4	0.3	0.7	0.2
80	9.0	8.0	9.6	9.2	7.9	9.8	-0.2	0.1	-0.2
85	6.7	5.9	7.1	7.4	6.4	7.8	-0.7	-0.5	-0.7
90	4.9	4.3	5.1	5.7	5.0	6.0	-0.8	-0.7	-0.9
95	3.5	3.1	3.6	4.4	3.8	4.5	-0.9	-0.7	-0.9
100	2.5	2.2	2.5	3.4	3.0	3.4	-0.9	-0.8	-0.9

Source: CRS compilation from National Center for Health Statistics, *National Vital Statistics Report*, "Deaths: Final Data for 2003," vol. 54, no. 13, Apr. 19, 2006.

Notes: Life expectancy at age 0 (at birth) measures the number of years that a child born in 2003 could expect to live, on average, if the mortality trends observed in 2003 were to continue for the rest of the newborn's life. Life expectancy at age 65 measures the number of additional years of life a person at age 65 will live, on average, given that he had already attained age 65 in 2003.

Data are based on a continuous file of records from the States. Calculations of life expectancy employ populations estimated as of July 1. Race categories are consistent with the 1977 Office of Management and Budget guidelines. Seven states California, Hawaii, Idaho, Maine, Montana, New York, and Wisconsin reported multiple-race data in 2003. The multiple-race data for these States were bridged by NCHS to the single categories of the 1977 OMB standards for comparability with other States. Data are subject to sampling or random variation.

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